Quantum Correlations in Chaotic Systems

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As quantum technologies increase in scale and complexity, new challenges arise in understanding and controlling large-scale quantum systems. Fundamental questions remain about the nature of quantum information, quantum-classical correspondence and the connection between chaos and quantum mechanics. We present our recent studies of quantum chaos, including the first simulations of chaos on a programmable quantum computer enabling access to dynamical regimes beyond the reach of traditional experimental methods. We have identified new periodic recurrences in a chaotic system that have no classical analog at any scale, thus challenging our understanding of standard Bohr quantum-classical correspondence. We also introduce contextuality as a novel and experimentally testable indicator of quantum chaos, providing a new diagnostic tool for probing quantum dynamics.